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An Overview of the Peach Industry of Spain

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Abstract

Important changes in the peach industry of Spain have occurred in recent years, including increases in acreage and production, and significant changes in the cultivars planted. Melting-flesh cultivars, primarily from North America, are replacing the traditional native, seed propagated, non-melting flesh Spanish populations. A description and comparison of the major peach growing areas in Spain are presented.

History of the Crop

Because of the wide diversity of peach germplasm in China and the extensive historical records of peach as a garden crop in that country, the hypothesis that China was the center of origin for peach has been accepted. The peach was spread from China to the Mediterranean countries through Persia. It was introduced to Greek culture between 400 and 300 B.C. and to the Romans in the first century A.D. (4). The spread throughout the European Mediterranean countries was made mainly by the Romans. Early peach culture was based on propagation by seeds. Successive generations of culture by seed followed by selection has occurred in different geographical locations, resulting in different 'native' populations. References dated from the twelfth and thirteenth century can be found describing culture of fruits such as fig, olive, almond, plum, apple, apricot and peach in Spain (1). The early production of fruit crops in Spain was located primarily in Mediterranean areas such as Valencia, Murcía or Andalusía. The Arabs engaged in fruit production in all areas where water was available. They also expanded the previous irrigated acreage of the Romans, which resulted in expansion of fruit crop culture. This production was mostly for local markets, however, a few early references about fruit trade between the central and the peripheral areas of Spain exist. Later in the sixteenth century the peach was introduced to Mexico and Florida by early Spanish explorers.

Early production of peach in Spain was restricted to those areas where the peach was well adapted. Numerous native, seed propagated populations of yellow, non-melting flesh, clingstone peaches arose in different areas of Spain. Expansion of peach culture was restricted due to the high sensitivity of peach to the alkaline soils, commonly found in many areas of Spain. Production during the nineteenth century was based almost entirely on seed propagation and no clonal cultivars were developed. Díaz-Cassou (2) described different peaches grown at this time according to the time of ripening, suggesting that no clonal varieties were available yet. Since the early twentieth century many growers utilized budding for propagation of trees, however most of the scion propagation stock came from seed-derived heterogeneous populations, because most production still relied on populations rather than on homogenous cultivars. Acreage in peach production rose during the 1960s and 1970s. Yield per hectare increased because better plant materials were available, including clonal selections from native populations and introduced cultivars from North America. Also, rootstocks adapted to alkaline soils were introduced, and land under irrigation expanded. Another marked expansion of the crop has occurred in the late 1980s and early 1990s. Since 1993 production has remained level.

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World production of peach from 1985 to 1993 has increased 24%. North American production increased 18% and production by countries in the European Union increased 25%. However, Spanish production increased 36% during this period. The expansion of the crop in Spain and Greece was significant during this period, while production in France and Italy remained stable (5).

Characteristics of Spanish Peach Production

Because the peach is primarily a tree of temperate zones, it can be grown in most parts of Spain from the north to the south, avoiding high altitudes or cold areas. However, main peach production areas are located in the northeastern, the eastern, and southern sections of Spain (Figure 1). In the northeastern and eastern part of Spain, the major regions of production are Catalonía, Murcía, Aragón and Valencia. Andalusía is the primary region of production in southern Spain.

Production from 1983 to 1993 increased an average of 37,000 metric tons per year (1992 was an exceptional crop year in Spain and has not been included). Although acreage has increased on average about 2,850 ha per year from 1983 to 1993, acreage has stabilized since 1990. A moderate increase in production can be expected from use of improved cultivars and renewal of plantations. Peach production by area and yield is shown in Figure 2A. Production per hectare varies between regions based on the extent of irrigation usage. In some areas, irrigation is not available and rainfall is low, causing a notable drop in yield. Figure 2B shows irrigated and non-irrigated peach acreage by area. In Valencia non-irrigated acreage is about 30% of the total, which partly explains the low average yield in this region.

Cultivars Grown

Peach production in Spain is based primarily on non-melting, yellow-fleshed fruit, representing about 60% of total production. Peaches grown represent seed propagated native populations, some clonal selections from native populations, and to a lesser extent some introduced cultivars such as the 'Baby Gold' series or 'Catherina.' About 30% of production is based on melting-flesh peaches, primarily from North America. Nectarine production account for 10% of the total. The trend is to increase the production of very early, melting-flesh cultivars. However, the repertoire of cultivars varies from one region to another because of climatic differences. Warmer regions such as western Andalusía, Murcía, eastern Catalonía and Valencia have shown an increase in the acreage of early cultivars in recent years, which makes the crop in these areas very profitable. Mid-season and late ripening fruit are produced in Catalonía, eastern Andalusía and Aragón. Melting-flesh cultivars that ripen in July or later must compete with the Italian, French and Greek production peaks, resulting in an excess of supply in the European Union market and lower prices. Fruit of non-melting flesh cultivars are sold only in domestic markets, so they do not command a price comparable to melting-flesh cultivars that are often exported.

Production in Different Regions

Andalusía. Two areas can be distinguished in this southern-most region: the western which includes the provinces of Sevilla, Córdoba, Huelva and Cadiz, and the eastern which includes Malaga, Jaen, Granada and Almeria. The western area represents 72% of the total production in Andalusía. Most of the production in Andalusía is based on very early and early melting flesh peaches, primarily various University of Florida cultivars, 'Goldcrest,' 'Maycrest,' 'Starlite,' 'Queencrest,' and 'Springcrest,' and 'Mayfire,' 'Maybelle,' and 'Armking' nectarines. Nearly 50% of peach and 26% of nectarine production occurs from late April through May. June accounts for 25% of peach and 68% of nectarine production, respectively. The major cultivars produced in June through mid-July are

'White Robin,' 'Merrill Gem Free,' and 'Flavorcrest' peaches, and 'Red Diamond,' 'Red June,' 'Snow Queen,' and 'Early Sungrand' nectarines. Production in the east of Andalusía is less important and is based on late season non-melting flesh types, primarily 'Baby Gold,' and the native populations 'Maruja' and 'Amarillo de Agosto.'

Aragón. This area produces predominantly late peaches, with the harvest season beginning in July and extending until late October. The production of early and mid-season cultivars, primarily 'Springcrest' and 'Maycrest' in June, and 'Merrill Gem Free,' 'Redhaven,' 'Redglobe,' 'Vesúvio,' 'Catherina,' 'Baby Gold' and 'Carson' in July, is not important and represents only about 14% of total production. Nectarines represent 2.7% of production in this region. The majority of peach production is based on non-melting flesh types, which represent 76.6% of total production. Of this amount, 72.4% is from native populations ripening in August, September and October. The predominant native population produced in August is 'San Lorenzo.' The native populations 'Miraflores,' 'Zaragozano,' and 'Rojo del Rito' are produced in September and collectively account for 25% of total peach production. Native populations 'Sudanell' and 'Amarillo de Agosto,' also produced in September, account for 12% and 11.4% of total production, respectively. Production in late September and October is based primarily on native populations of 'Calandas.'

Catalonía. In Catalonía, 73.2% of total peach production and 86.6% of total nectarine production is located in the province of Lleida. The production season ranges from June (8.2% of total peach and 14.6% of total nectarine production) through October. Cultivars grown during June are primarily yellow and melting flesh, represented by 'Springtime,' 'Prime Rosa,' 'Cardinal,' 'Springcrest,' 'Dixired,' 'Maycrest,' and 'Pepita' peaches, and 'Snow Queen,' 'Armking II,' and 'Mayfire' nectarines. Peak production occurs in July and August (20.5% and 28.3% of total peach production, and 15.9% and 29.8% of total nectarine production, respectively). Both melting and non-melting flesh peaches are grown at this time, but non-melting flesh types predominate. Major peach cultivars produced in July and August include 'White Globe,' 'Redwing,' 'Flavorcrest,' 'Redglobe,' 'Royal Glory,' Catherina,' and 'Maria Serena.' The major nectarines are 'Flavor Giant,' 'Modina,' 'Maria Laura,' Flavortop,' 'Independence,' and various 'Nectared' cultivars. In September, representing 15.4% of peach and 17.6% of nectarine total production, almost all peach cultivars grown are non-melting flesh. The primary peaches produced in September are 'Gladys,' 'Autumn White,' 'Merrill Sundance,' 'Laura,' and 'Cal Red,' while the major nectarines are 'September Queen,' 'Fairlane,' 'Flamekist' and 'Tasty Free.' In some areas the harvest season is extended until mid-October, based on the production of the native populations 'Calandas,' 'Rojo Pinyana,' and 'Rojo de Octubre.'

Murcia. This area has a traditional crop of non-melting flesh peaches. Three important native populations have originated here: 'Marujas,' 'Jerónimos' and 'Calabaceros.' Recently some of these traditional peaches have been replaced by early-ripening, melting-flesh cultivars such as 'May Crest,' 'Springcrest,' 'Zincal' and Maybelle,' and some nectarines such as 'Mayfire.' In 1983, production of non-melting flesh peaches in Murcía represented 86% of total; by 1993 it had dropped to 65%. In the last 10 years, the harvest season has been extended, beginning in May based on melting-flesh cultivars from North America. It continues with the native populations 'Maruja' and 'Jerónimos' ripening in early and late July, representing 24% and 18% of production, respectively. Production in August is based on the native populations 'Calabaceros' and 'Sudanell,' representing 5% and 4% of total production, respectively. Murcía is the leading producer of flat peaches, commonly called

'Paraguayos,' representing about 8% of total production.

Valencia. The harvest season in this eastern region begins in late April with melting flesh cultivars from North America, and concludes at the end of September with non-melting flesh fruits from native populations, primarily 'Cofrentes.' The previously grown native populations 'Cotiguas' and 'Selma' have disappeared, and 'Cofrentes' is declining in numbers. Most non-melting flesh production is now based on the North American cultivars 'Baby Gold' and 'Catherina.' Production of early ripening, melting-flesh peaches and nectarines has increased dramatically in recent years. Very early cultivars, ripening from late April through May, represent 37% of total yearly production. Predominant cultivars include 'Flordadawn,' 'Flordaking,' Flordastar,' 'Zincal,' 'Silver King,' 'Mayfire' and 'Springcrest.' Early cultivars ripening in June and early July represent 18.3% of total yearly production, and include 'Springcrest' and 'Merrill Gem Free.' Nectarine production represents 17.8% of total production. In summary, production in April through early July in Valencia is based primarily on melting flesh peaches and nectarines, representing about 74% of total production. Production from middle July through September was historically based on the non-melting flesh native populations 'Marajus,' 'Jerónimos,' 'San Lorenzo' and 'Amarillo de Agosto,' but the North American non-melting flesh cultivars 'Baby Gold' and 'Catherina' are becoming more widely used than these traditional native selections. The native population named 'Cofrentes,' which is the latest cultivar of the season in Valencia and is produced in a small area called the Ayora Valley, is still used for local markets.

Cultivar Selection and Peach Breeding in Spain

Improvement of peach germplasm in Spain began in the 1960s. Much of the work was focused on clonal selection of native populations. Clones of 'Marujas,' 'Calabaceros' and 'Jerónimos' were selected by the Experimental Station of "Aula Dei" in Zaragoza and the "Centro de Edafoloja y Biologia Aplicada del Segura" known as CEBAS in Murcía. From these selections virus-free clones were developed by Instituto Valenciano de Investigaciones Agrarias (IVIA). In the 1970s and early 1980s, clonal selection of 'Calandas' native populations was conducted by the Servicio de Investigación Agraria (SIA) in Zaragoza. Several selected clones were released and other are still under selection (3).

Selections for peach rootstock improvement has been conducted by the SIA in Zaragoza and several important rootstocks have been released. Peach breeding programs to improve varieties have recently started in Catalonía by a commercial nursery and in Valencia at IVIA.

Rootstocks

Rootstock selection in Spain is based primarily on soil characteristics, graft compatibility, disease resistance and performance on replant sites. Most peach cultivars are propagated on peach seedling rootstock obtained from seed of non-melting flesh native populations. Peach seedling rootstocks are vigorous, and show good compatibility with all cultivars. They are sensitive to *Armillaria mellea* (Vahl:Fr) P. Kumm., nematodes, and crown gall *Agrobacterium tumefaciens* (Smith & Townsend). They show good behavior in well drained, slightly acidic soils. Because alkaline soils are present in most of the peach production areas in Spain, these rootstocks have been replaced by GF-677, a hybrid of peach x almond. Unfortunately this rootstock confers excessive vigor, producing large trees that are more expensive to prune and harvest. The future goal is to develop a hybrid rootstock that is resistant to alkaline conditions and nematodes, but less vigorous than GF-677. In Murcía, scientists have selected and tested clones from 'Pollizo de Murcía,' a native population of *Prunus insititia* type 'San Julian.' These

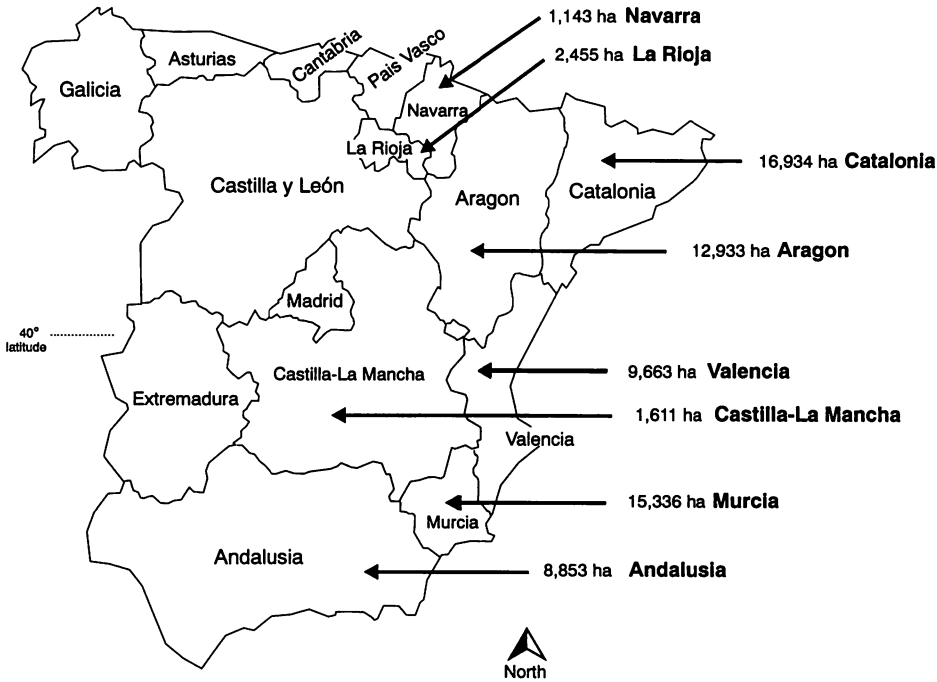

Figure 1. Major peach growing regions of Spain and hectares of production.

rootstocks are very well adapted to poor soils with poor drainage, alkalinity and salinity, but demonstrate a lack of graft compatibility with some peach cultivars.

Cultural Practices

Most peach trees in Spain are trained to the open-vase form. About 10% or less of the peach orchards located in Catalonía are trained as palmettes. Disease and insect pests found in Spain are those typically encountered in North America. Interestingly, bacterial spot disease caused by *Xanthomonas arboricola* pv. pruni (Smith 1903) Vauterin, Hoete, Kersters & Swings 1995, is not found in Spain, although susceptible cultivars are grown and it is found in neighboring European countries. The Mediterranean Fruit Fly (Ceratitis capitata Wiedmann) is a very serious problem in Spain, particularly in late season cultivars, and requires regular application of pesticides for control.

Drip irrigation is the most widely used irrigation system in new orchards. However, in some areas where orchards have been long established the flooding system is used commonly.

Low chilling cultivars have an extended blooming season and usually are affected by spring frosts, and consequently require little thinning. In later blooming cultivars thinning of the fruit is done by hand and is very costly. Thinning usually is conducted during pit hardening. In Aragón, fruits from native populations of 'Calandas' are individually covered with a bag at the time of thinning, protecting them from the Mediterranean Fruit Fly, birds, and other pests. This practice increases production costs but results in high quality fruit and reduces the need for pesticides.

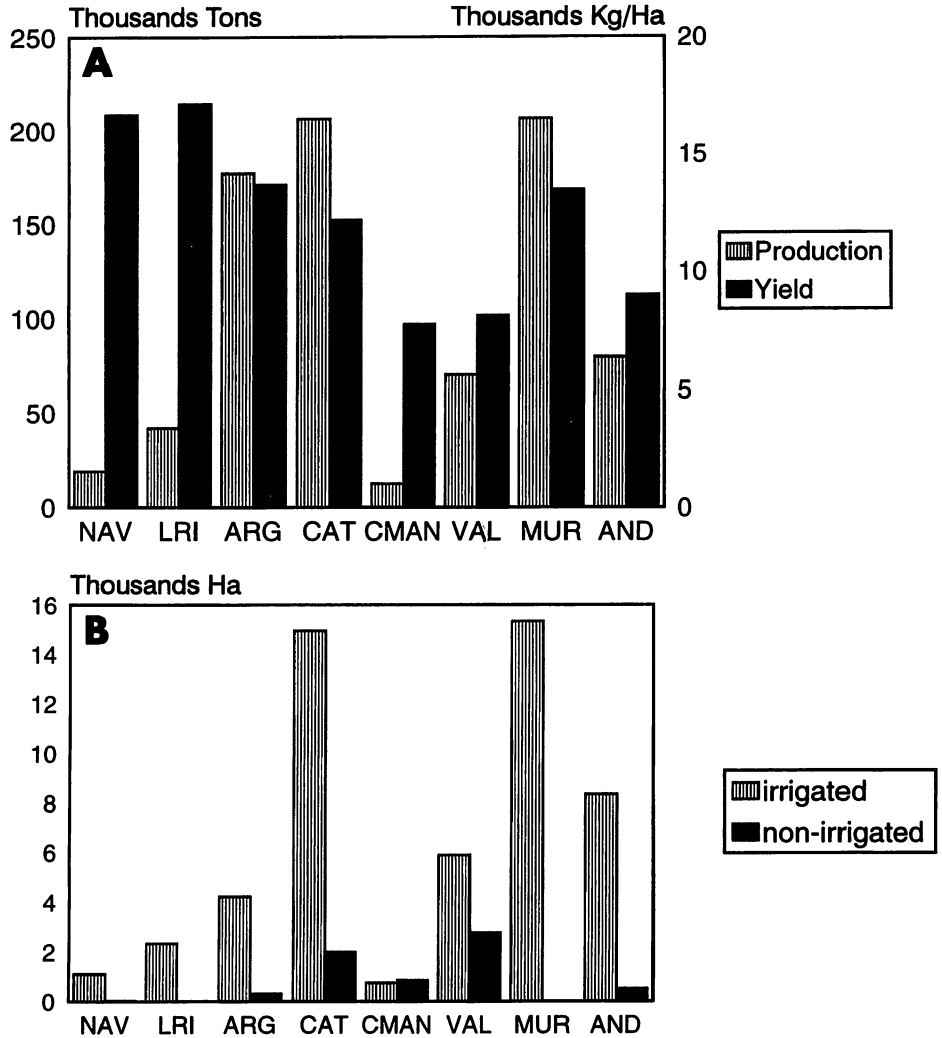

Figure 2. A. Total production (thousand of metric tons) and yield (thousand kg/ha) in the major peach growing areas of Spain for 1993. B. Irrigated and non-irrigated peach acreage in the major peach growing regions of Spain for 1993. From left to right in both figures: Navarra (NAV), La Rioja (LRI), Aragón (ARG), Catalonia (CAT), Castilla La Mancha (CMAN), Valencia (VAL), Murcía (MUR) and Andalusía (AND).

Marketing

The majority of the peach crop in Spain is sold fresh (80%), including both melting and non-melting flesh peaches and nectarines. Only 20% of total production is processed. About 60.6% of the processed fruit is canned with syrup, 10.1% for jam production, 25.1% for juice and 4.2% for dried fruits. Spain exports 12% of the fresh production and about 10% of the processed fruit, mostly to other European Union countries.

Major Problems in Peach Production and the Future of the Industry

Replanting an orchard on land previously established in peach is a serious challenge in Spain. Preplant soil fumigation for peach is rarely practiced. In most cases a change of rootstock species may be necessary on replant sites. An alternative rootstock to GF-677 that would confer less vigor and perform well on replant sites would be valuable.

The small average size of peach orchards and low tree density in Spain are handicaps relative to optimum management and lower costs. Although orchards are operated by independent growers, they usually are associated with co-operative organizations for marketing purposes. In the new European Union framework for fruits, these co-operative organizations will become critical for marketing of peaches.

In areas where early cultivars can be grown, such as Andalusía, Murcía and Valencia, a need for new well adapted cultivars has arisen. Some cultivars with low chilling requirements have been introduced recently, but success has been irregular. The occurrence of warmer than usual winters, spring frost, and the use of growth regulators without previous experience has resulted in inconsistent production. The native populations, which are primarily mid-season and late ripening, are becoming less competitive because of the excess of supply in the market during summer. In areas where late cultivars can be grown (Catalonía, Aragón, inland Valencia) an extension of the crop season to late fall is possible; however the need to control the Mediterranean Fruit Fly will increase the cost of production, so such extension may not be economically feasible. Most of the late production is based on non-melting flesh peaches that are not preferred by most European consumers. An extension of the crop season to include very early cultivars that ripen from April through June seems appropriate. The peach supply in the markets is very low at this time and some peach growing areas of Spain have favorable environmental conditions for production of very early cultivars.

In conclusion, although the peach acreage has stabilized during the last 5 years, an increase in yield and total production can be expected, as well as changes in the repertoire of cultivars. A notable trend occurring in the warmer production areas is a shift to North American peach and nectarine cultivars. The role of native peaches is becoming less important in these areas. Unfortunately, this is resulting in a rapid loss of genetic diversity that is inherent in seed propagated native populations. Greater use of irrigation, use of selected rootstocks, development of improved cultivars and better management of orchards will lead to production of high quality fruits. Only growers of high quality peaches will be successful in a more and more competitive market. Also, an increased consumption of non-melting flesh peaches as fresh fruit by European customers would benefit the Spanish peach industry.

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